

WHAT IS CLAIMED IS

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1. An image data processing apparatus comprising:

10 a part at least reducing the deviation on a pixel having a value deviating from a predetermined range through inverse transform of image data from a frequency domain; and

15 a part determining a pixel which should have a value changed in a direction reverse to the deviation based on a character of the inverse transform.

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2. The image data processing apparatus as 20 claimed in claim 1, wherein:

the character of the inverse transform used by said determining part comprises polarities of elements of a matrix through which the inverse transform is performed.

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3. The image data processing apparatus as  
claimed in claim 2, wherein the character of the inverse  
transform used by said determining part further  
comprises absolute values of the elements of the matrix  
5 through which the inverse transform is performed.

10 4. The image data processing apparatus as  
claimed in claim 1, wherein:  
the character of the inverse transform used by  
said determining part comprises probabilistic magnitude  
relationship among products between elements of a matrix  
15 through which the inverse transform is performed and  
quantization errors occurring in frequency transform  
coefficients multiplied with the elements, respectively.

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5. The image data processing apparatus as  
claimed in claim 1, further comprising:  
a part which, in case the pixel determined by  
25 said determining part to have the value changed in the

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direction reverse to the deviation then has a value deviating from the predetermined range as a result of having the value changed in the direction reverse to the first occurring deviation, determines a pixel which 5 should have a value changed in a direction reverse to the second occurring deviation based on a character of the inverse transform.

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6. The image data processing apparatus as claimed in claim 5, wherein:

the character of the inverse transform used by 15 said part which determines the pixel which should have the value changed in the direction reverse to the second occurring deviation comprises the polarities of the elements of the matrix through which the inverse transform is performed.

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7. The image data processing apparatus as 25 claimed in claim 6, wherein:

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the character of the inverse transform used by  
said part which determines the pixel which should have  
the value changed in the direction reverse to the second  
occurring deviation further comprises the absolute  
5 values of the elements of the matrix through which the  
inverse transform is performed.

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8. The image data processing apparatus as  
claimed in claim 1, wherein:

the pixel determined by the part to have the  
value changed in the direction reverse to the deviation  
15 is one vertically, horizontally or diagonally adjacent  
to the pixel which has the first occurring deviation.

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9. The image data processing apparatus as  
claimed in claim 5, wherein:

the pixel determined by the part to have the  
value changed in the direction reverse to the first  
25 occurring deviation is one vertically adjacent to the

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pixel which has the first occurring deviation; and  
the pixel determined by the part to have the  
value changed in the direction reverse to the second  
occurring deviation is one horizontally or diagonally  
5 adjacent to the pixel having the second occurring  
deviation.

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10. The image data processing apparatus as  
claimed in claim 5, wherein:

the pixel determined by the part to have the  
value changed in the direction reverse to the first  
15 occurring deviation is one diagonally adjacent to the  
pixel which has the first occurring deviation; and

the pixel determined by the part to have the  
value changed in the direction reverse to the second  
occurring deviation is one horizontally or vertically  
20 adjacent to the pixel having the second occurring  
deviation.

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11. The image data processing apparatus as  
claimed in claim 5, wherein:

the pixel determined by the part to have the  
value changed in the direction reverse to the first  
5 occurring deviation is one horizontally adjacent to the  
pixel which has the first occurring deviation; and

the pixel determined by the part to have the  
value changed in the direction reverse to the second  
occurring deviation is one vertically or diagonally  
10 adjacent to the pixel having the second occurring  
deviation.

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12. The image data processing apparatus as  
claimed in claim 1, wherein the amount by which the part  
at least reduces the deviation is the same as the amount  
by which the pixel should have the value changed in the  
20 direction reverse to the deviation.

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13. The image data processing apparatus as

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claimed in claim 1, wherein:

the inverse transform from the frequency domain is performed on a color difference component of the image data; and

5 the thus-obtained R, G or B value is regarded as the data of the relevant pixel processed by said parts.

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14. The image data processing apparatus as claimed in claim 1, wherein:

the inverse transform from the frequency 15 domain is performed on a brightness component of the image data; and

the thus-obtained G value is regarded as the data of the relevant pixel processed by said parts.

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15. The image data processing apparatus as claimed in claim 1, further comprising a part of

25 switching as to whether the deviation occurring on a

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pixel is dealt with by causing a predetermined pixel to have a value changed accordingly or by merely rounding the value of the pixel originally having the deviation, based on a quantization rate applied in quantization 5 performed on coefficients of the frequency domain.

10               16. The image data processing apparatus as claimed in claim 1, further comprising a part of switching as to whether the deviation occurring on a pixel in G value is dealt with by causing a predetermined pixel to have a G value changed 15 accordingly or by merely rounding the G value of the pixel originally having the deviation, based on a quantization rate applied in quantization performed on coefficients of the frequency domain..

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17. The image data processing apparatus as claimed in claim 1, further comprising a part of 25 rounding a G value of a pixel, in case the G value

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deviates from the predetermined range through the inverse transform of image data from the frequency domain

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18. The image data processing apparatus as claimed in claim 1, wherein:

10 the image data to undergo the inverse transform comprises image data having undergone S-transform and thus transformed into the frequency domain, where the S-transform has a character such that half the frequency coefficient HH has an quantization error  
15 probabilistically minimum among the frequency coefficients LH, HL and HH/2 obtained through the S-transform.

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19. The image data processing apparatus as claimed in claim 1, wherein:

the image data to undergo the inverse  
25 transform comprises image data having undergone  $5 \times 3$

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wavelet transform or  $9 \times 7$  wavelet transform and thus transformed into the frequency domain; and

5       said determining part determines a pixel which should have a value changed in a direction reverse to the deviation as being a pixel vertically or horizontally adjacent to the pixel having the deviation.

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20. An image data processing method comprising the steps of:

15       a) at least reducing the deviation on a pixel having a value deviating from a predetermined range through inverse transform of image data from a frequency domain; and

20       b) determining a pixel which should have a value changed in a direction reverse to the deviation based on a character of the inverse transform.

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21. The method as claimed in claim 20,  
25       wherein:

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the character of the inverse transform used by  
said step b) comprises polarities of elements of a  
matrix through which the inverse transform is performed.

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22 The method as claimed in claim 21, wherein  
the character of the inverse transform used by said step  
10 b) further comprises absolute values of the elements of  
the matrix through which the inverse transform is  
performed.

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23. The method as claimed in claim 20,  
wherein:

the character of the inverse transform used by  
20 said step b comprises probabilistic magnitude  
relationship among products between elements of a matrix  
through which the inverse transform is performed and  
quantization errors occurring in frequency transform  
coefficients multiplied with the elements, respectively.

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24. An information recording medium having a software program recorded therein, the software program causing a computer to execute the steps of:

- a) at least reducing the deviation on a pixel
- 5 having a value deviating from a predetermined range through inverse transform of image data from a frequency domain; and
- b) determining a pixel which should have a value changed in a direction reverse to the deviation
- 10 based on a character of the inverse transform.

15 25. The recording medium as claimed in claim 24, wherein:

the character of the inverse transform used by said step b) comprises polarities of elements of a matrix through which the inverse transform is performed.

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26. The recording medium as claimed in claim 25, 25, wherein the character of the inverse transform used

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by said step b) further comprises absolute values of the elements of the matrix through which the inverse transform is performed.

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27. The recording medium as claimed in claim 24, wherein:

10                   the character of the inverse transform used by said step b) comprises probabilistic magnitude relationship among products between elements of a matrix through which the inverse transform is performed and quantization errors occurring in frequency transform  
15                   coefficients multiplied with the elements, respectively.

20                   28. A software program causing a computer to execute the steps of:

25                   a) at least reducing the deviation on a pixel having a value deviating from a predetermined range through inverse transform of image data from a frequency domain; and

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b) determining a pixel which should have a value changed in a direction reverse to the deviation based on a character of the inverse transform.

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29. The program as claimed in claim 28,  
wherein:

10 the character of the inverse transform used by  
said step b) comprises polarities of elements of a  
matrix through which the inverse transform is performed.

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30. The program as claimed in claim 29,  
wherein the character of the inverse transform used by  
said step b) further comprises absolute values of the  
20 elements of the matrix through which the inverse  
transform is performed.

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31. The program as claimed in claim 28,  
wherein:

the character of the inverse transform used by  
said step b) comprises probabilistic magnitude  
5 relationship among products between elements of a matrix  
through which the inverse transform is performed and  
quantization errors occurring in frequency transform  
coefficients multiplied with the elements, respectively.

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